

I claim:

1. A syringe plunger handle assembly for use in a syringe barrel to inject fluid, comprising:

an elongated plunger formed with a longitudinally extending generally tubular wall defining a hollow interior along the length of the plunger, the plunger having a head end in front and a rear end portion with a thumb cap behind;

the outer side of the wall at the head end has a plunger seal adapted to slide in sealed contact with a tubular wall when the plunger is moved within a syringe barrel;

the wall at the head end of the plunger has a reduced diameter front portion extending forwardly beyond the plunger seal to a tip at the front of the plunger defining an opening within the front end portion leading into the hollow interior, the wall behind the tip having a stepped inner side surface comprising a land having an inwardly facing surface and a larger diameter portion extending behind the land into the hollow interior;

a separate dislodgeable stopper slidingly held within the reduced diameter front portion of the plunger head by a holding force in excess of an expected fluid injection pressure force during use of the plunger in a syringe barrel, the stopper having a back end portion comprising a land and a reduced diameter front end portion extending a fixed distance forwardly beyond the tip, the stopper land having an outwardly facing surface in sliding sealed engagement with the inwardly facing surface of the land in the plunger wall, said lands comprising cooperating lands which apply said holding force to the stopper and seal the hollow interior of the plunger from said expected fluid injection pressure force; and

the cooperating lands have sufficient length to allow the dislodgeable stopper to move said fixed distance back to the tip in sliding response to forward movement of the plunger after the front of the stopper contacts a stop, whereby said holding force is reduced by substantial disengagement of the cooperating lands in preparation for dislodgement of the stopper without unsealing the hollow interior of the plunger.

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2. The syringe plunger handle assembly of Claim 1 wherein a vent for the hollow interior is located at the rear end portion of the plunger.

3. The syringe plunger handle assembly of Claim 2 wherein the thumb cap at the rear end portion of the plunger is provided with a channel which receives vented air from the hollow interior.

4. The syringe plunger handle assembly of Claim 3 wherein said vent comprises at least one groove at the rear end portion of the plunger in fluid communication with said channel for venting the retraction cavity in the plunger.

5. The syringe plunger handle assembly of Claim 1 wherein the thumb cap at the rear end portion of the plunger surrounds an opening suitable for installation of the dislodgeable stopper into the hollow interior and a closure for the opening in the thumb cap.

6. The syringe plunger handle assembly of Claim 5 wherein at least one channel in the thumb cap receives vented air from the hollow interior.

7. The syringe plunger handle assembly of Claim 6 wherein the closure has at least one cutaway side portion in joint fluid communication with the hollow interior and said channel to create a vent passage.

8. The syringe plunger handle assembly of Claim 7 wherein the rear end portion of the plunger has an internal surface with at least one groove in fluid communication with the hollow interior and said at least one channel in the thumb cap.

9. The syringe plunger handle assembly of Claim 5 wherein the closure has a headed portion fitted in the opening in the thumb cap and a skirted side containing an undercut configured to reside in fluid communication jointly with the hollow interior and at least one channel in the thumb cap to comprise at least one vent passage from the hollow interior.

10. A syringe plunger handle assembly and syringe barrel combination for use in injecting fluids, comprising:

a hollow syringe body having a longitudinally extending tubular wall comprising an elongated barrel portion having a back end portion with an opening behind and a nose in front, 5 said nose having a reduced cross-sectional area relative to the barrel;

an elongated plunger formed with a longitudinally extending generally tubular wall defining a hollow interior along the length of the plunger, the plunger having a head end in front mounted in the syringe body and a rear end portion with a thumb cap behind extending from said opening in the barrel;

10 the outer side of the wall at the head end has a plunger seal adapted to slide in sealed contact with the tubular wall when the plunger is moved within the syringe barrel;

15 the wall at the head end of the plunger has a reduced diameter front portion extending forwardly beyond the plunger seal to a tip at the front of the plunger defining an opening within the front end portion leading into the hollow interior, the wall behind the tip having a stepped inner side surface comprising a land having an inwardly facing surface and a larger diameter portion extending behind the land into the hollow interior;

20 a separate dislodgeable stopper slidingly held within the reduced diameter front portion of the plunger head by a holding force in excess of an expected fluid injection pressure force during use of the plunger in the syringe barrel, the stopper having a back end portion comprising a land and a reduced diameter front end portion extending a fixed distance forwardly beyond the tip, the stopper land having an outwardly facing surface in sliding sealed engagement with the inwardly facing surface of the land in the plunger wall, said lands comprising cooperating lands

which apply said holding force to the stopper and seal the hollow interior of the plunger from expected fluid injection pressure force;

the cooperating lands have sufficient length to allow the dislodgeable stopper to move said fixed distance back to the tip in sliding response to forward movement of the plunger after the front of the stopper contacts a stop, whereby said holding force is reduced by substantial disengagement of the cooperating lands in preparation for dislodgement of the stopper without unsealing the hollow interior of the plunger; and

further forward movement of the plunger causing dislodgement of the stopper from the opening accompanied by reception of the thumb cap within the confines of the opening at the back end portion of the barrel thereby preventing reuse.

11. The combination of Claim 10 wherein the hollow interior of the plunger is provided with a vent passage in a rear portion thereof behind the plunger seal member.

12. The combination of Claim 11 wherein the thumb cap at the rear end portion of the plunger is provided with a channel which receives vented air from the hollow interior.

13. The combination of Claim 12 wherein the back end portion of the barrel of the syringe body includes at least one slot which allows vented air to escape without being trapped by a user's thumb during retraction when the thumb cap is pressed down and received in said opening in the barrel at the back of the syringe body.

14. The combination of Claim 12 wherein said vent comprises at least one groove at the rear end portion of the plunger in fluid communication with said channel for venting the retraction cavity in the plunger.

15. The combination of Claim 14 wherein the thumb cap at the rear end portion of the plunger surrounds an opening suitable for installation of the dislodgeable stopper into the hollow interior and a closure for the opening in the thumb cap.

16. The combination of Claim 15 wherein the closure has at least one cutaway side portion in joint fluid communication with the hollow interior and said channel to create a vent passage.

17. The combination of Claim 16 wherein the rear end portion of the plunger has an internal surface with at least one groove in fluid communication with the hollow interior and said at least one channel in the thumb cap.

18. The combination of Claim 17 wherein the back end portion of the barrel of the syringe body includes at least one slot which allows vented air to escape without being trapped by a user's thumb during retraction when the thumb cap is pressed down and received in said opening in the barrel at the back of the syringe body.

19. A tamperproof retractable non-reusable syringe structure designed to have a high blowout pressure coupled with a low retraction force, comprising:

a hollow outer body having a longitudinally extending wall comprising an elongated barrel having a back end portion with an opening behind and a nose in front, said nose having a reduced cross-sectional area relative to the barrel;

a retraction mechanism having retractable parts comprising an elongated needle holder and spring combination mounted in the nose portion of the barrel with the needle holder temporarily held in a use position with a needle attached to the needle holder extending from the nose of the barrel and a fluid path through the needle and needle holder leading to a variable fluid chamber in the barrel;

a hollow plunger handle assembly disposed partially within the elongated barrel of the outer body, the plunger having a head in front with a piston fixedly mounted thereon in slidable sealed contact with the interior of the barrel, a back end portion having a graspable end cap and a retraction cavity therein, the plunger head having a tip in front defining an opening into the retraction cavity and a separate dislodgeable stopper slidably sealing the opening, said stopper having a front end portion extending a distance beyond the tip, the stopper being capable of sliding relative to the plunger back to the tip without unsealing the opening and without completely dislodging in response to forward motion of the plunger after the front end portion of the stopper has come into contact with the needle holder;

the combined head of the plunger and the stopper defining the upper boundary of the variable fluid chamber;

the plunger being movable to a second position while expelling fluid contained in the variable chamber through the fluid path in response to thumb pressure on said cap, said second position comprising the end of an injection cycle including sliding of the stopper said distance relative to the plunger tip after contact with the needle holder at the end of the injection cycle
5 before retraction occurs;

the plunger being further depressible to a retraction position beyond said second position whereby the retraction mechanism temporarily holding the needle holder releases the needle holder to carry said stopper and said needle into the retraction cavity and said graspable end cap is simultaneously recessed into the opening at the back of the barrel so the syringe cannot be
10 reused.

20. The tamperproof retractable non-reusable syringe structure of Claim 19 wherein the plunger has at least one vent passage spaced behind the piston, in fluid communication with the retraction cavity, to allow venting of air from the retraction cavity in response to entry of retractable parts therein, sufficient to prevent compression and blow by of air into the variable fluid chamber which could otherwise expel residual fluid from the nose of the syringe.

21. The tamperproof retractable non-reusable syringe structure of Claim 20 wherein the thumb cap at the rear end portion of the plunger surrounds an opening suitable for installation of the dislodgeable stopper into the plunger and a closure for the opening.

22. The tamperproof retractable non-reusable syringe structure of Claim 21 wherein said at least one vent passage comprises a channel in the thumb cap leading outward from the opening at the rear end portion of the plunger.

23. The tamperproof retractable non-reusable syringe structure of Claim 22 wherein the closure has at least one cutaway side portion in fluid communication with the retraction cavity and said channel to create said at least one vent passage.

24. The tamperproof retractable non-reusable syringe structure of Claim 23 wherein the wall of the barrel near the opening includes at least one slot which allows vented air to escape without being trapped by a user's thumb during retraction when the thumb cap is pressed down, received and recessed in the opening in the back end portion of the barrel of the syringe body.

25. The tamperproof retractable non-reusable syringe structure of Claim 22 wherein the back end portion of the plunger has an internal surface with at least one groove in fluid communication with said channel in the thumb cap to comprise said at least one vent passage.

26. The tamperproof retractable non-reusable syringe structure of Claim 25 wherein the back end portion of the barrel of the syringe body includes at least one slot which allows vented air to escape without being trapped by users thumb during retraction when the thumb cap is pressed down and received in the opening of the barrel at the back of the syringe body.

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27. The tamperproof retractable non-reusable syringe structure of Claim 21 wherein the closure has a headed portion fitted in the opening at the rear end of the plunger and a depending skirted side containing an undercut configured to reside in fluid communication jointly with the retraction cavity and at least one channel in the thumb cap to comprise said at least one vent passage.

28. The tamperproof retractable non-reusable syringe structure of Claim 27 wherein the back end portion of the barrel of the syringe body includes at least one slot which allows vented air to escape without being trapped by a user's thumb during retraction when the thumb cap is pressed down and received in said opening in the barrel at the back of the syringe body.

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